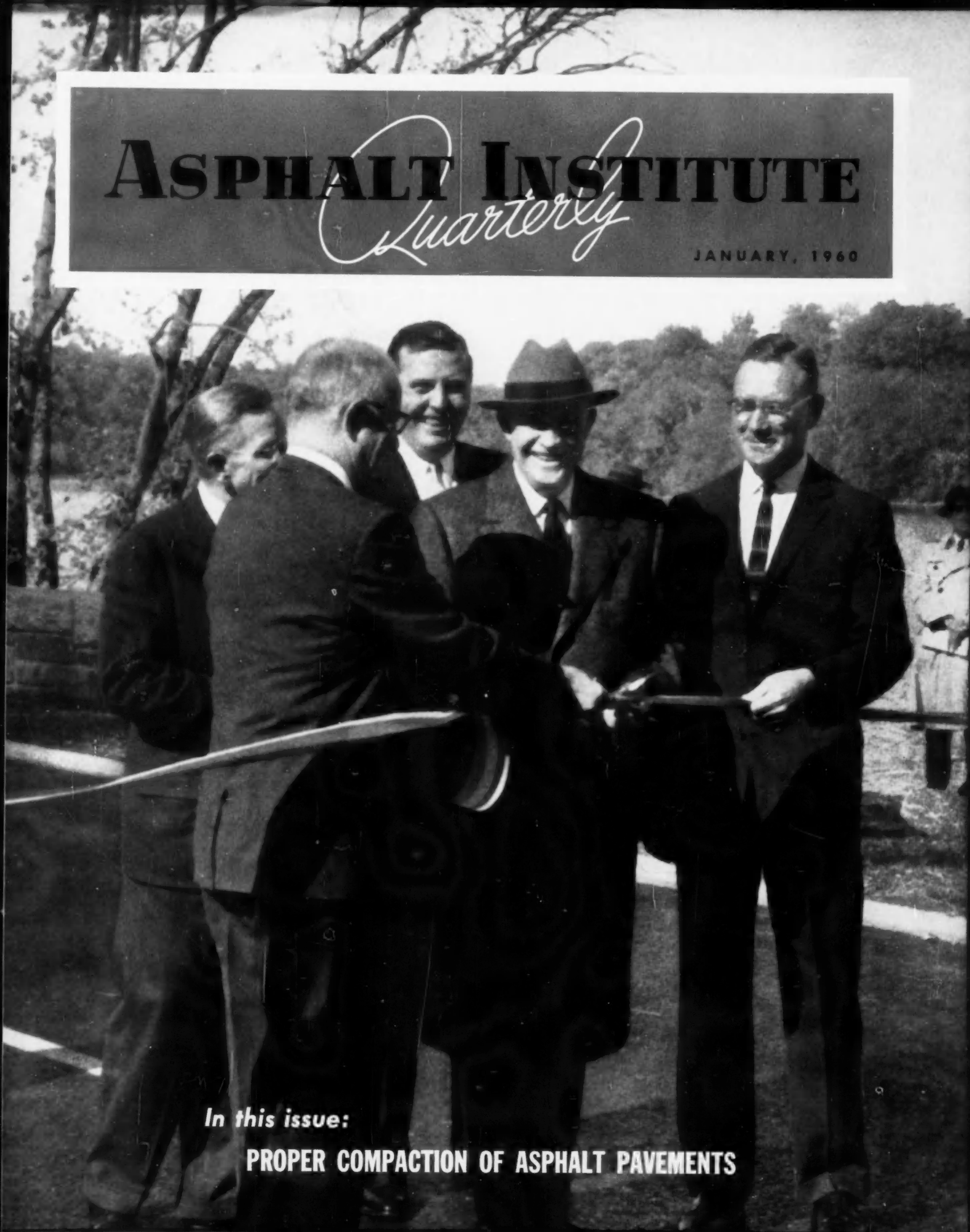
ASPHALT INSTITUTE *Quarterly*

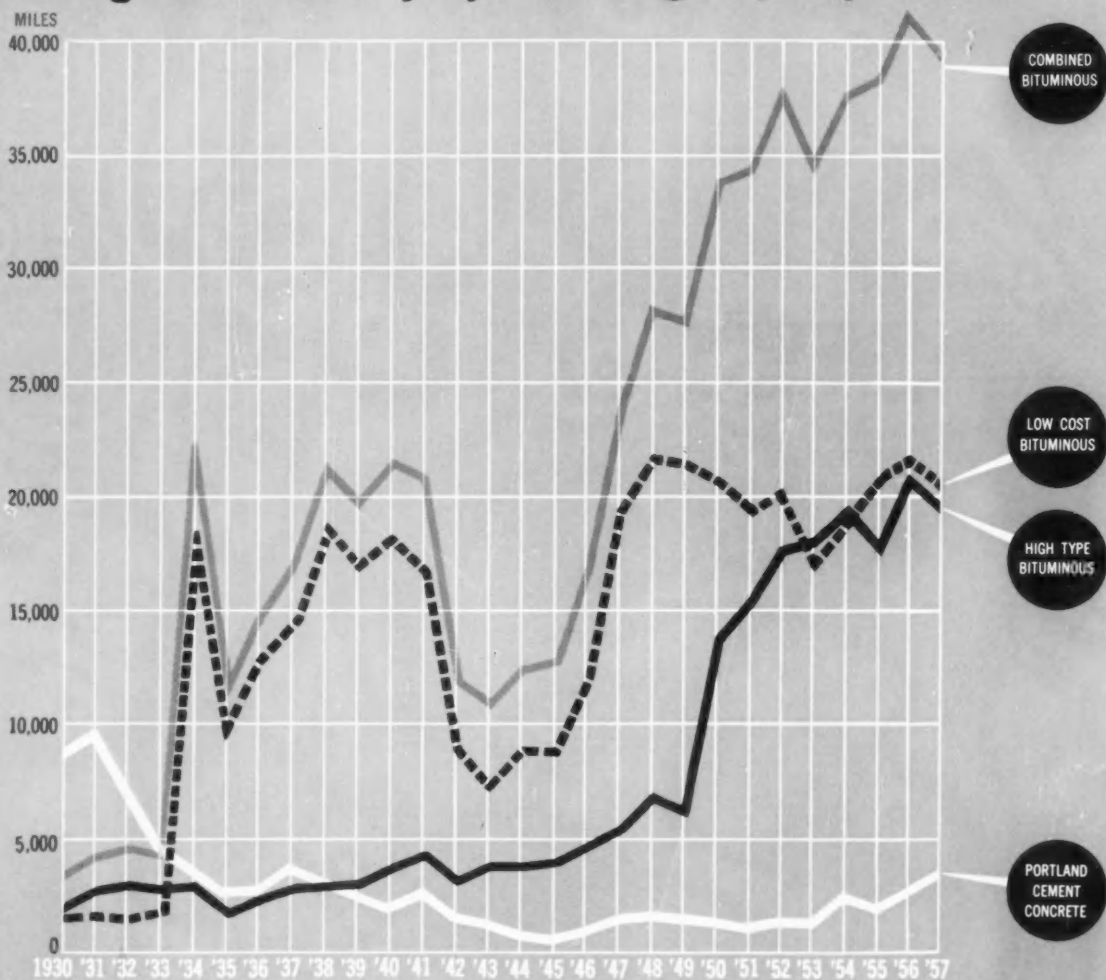
JANUARY, 1960



In this issue:

PROPER COMPACTION OF ASPHALT PAVEMENTS

Mileage Built Annually By State Highway Departments



IN 1957, 94% OF ALL PAVED MILEAGE CONSTRUCTED BY STATE HIGHWAY DEPARTMENTS WAS SURFACED WITH ASPHALT

CHARTED BY THE ASPHALT INSTITUTE

Source: U.S. Bureau of Public Roads *Tables SMB 1-5*

EDITORIAL:

Asphalt Base for Modern Traffic

Asphalt base is not new. It was standard design as far back as a half a century ago. But it was identified principally with city street construction where a large volume of heavy loads concentrated on narrow steel-rimmed wheels or solid rubber tires were anticipated. With the development of the balloon tire which spread the load over a much larger contact area, the use of the thick asphalt courses was considered unnecessary.

Two important developments have kindled fresh interest in asphalt bases for modern arterial highways: the rising volume of heavy wheel loads with higher tire pressures and a steadily increasing shortage in some areas of quality aggregates for base construction. The advantages of asphalt base construction may be enumerated as follows:

TEN ADVANTAGES

1. Compared with granular bases of the same thickness they reduce considerably the traffic stresses imposed on the subgrade;

2. They need not normally be as thick as granular bases, thus reducing the total thickness design for the pavement structure;

3. Local materials of a quality not satisfactory for standard granular bases may be employed;

4. Construction delays due to bad weather are held to a minimum since asphalt bases may be laid rapidly by machine and consolidated promptly, making them at once watertight and usable;

5. They protect the subbase from rain and permit haul traffic to use the roadway without damage;

6. Asphalt bases may be opened to traffic for a year or more before any surfacing is laid, allowing full time for possible settlement;

7. They require no protection from frost;

8. They prevent capillary moisture and water vapor from accumulating in the pavement courses where high strength is required;

9. Asphalt bases have uniformity which varies little from place to place;

10. Machine-laid asphalt bases improve appreciably the riding qualities of the final surfacing.

ASPHALT INSTITUTE *Quarterly*

Vol. 12, No. 1 *January, 1960*

Glynn Harvey
Editor

Contents

Cover

Another one of Virginia's fine asphalt-paved roads is dedicated with President Eisenhower wielding the traditional shears. The occasion was the opening of another stretch of the George Washington Memorial Highway, a segment of District of Columbia circumferential network, skirting the Virginia bank of the Potomac River.

—*Washington Post Photo*

The Asphalt Institute Quarterly is published by the Asphalt Institute, an international nonprofit association sponsored by members of the petroleum asphalt industry to serve both users and producers of asphaltic materials through programs of engineering research and education.

The member companies of the Institute, who have made possible the publication of this magazine, are listed on page 15.

Articles may be reprinted with credit line. Correspondence should be addressed to the Asphalt Institute Quarterly, Asphalt Institute Building, University of Maryland, College Park, Maryland.

The State of Ohio pioneered with the rubber-tire roller

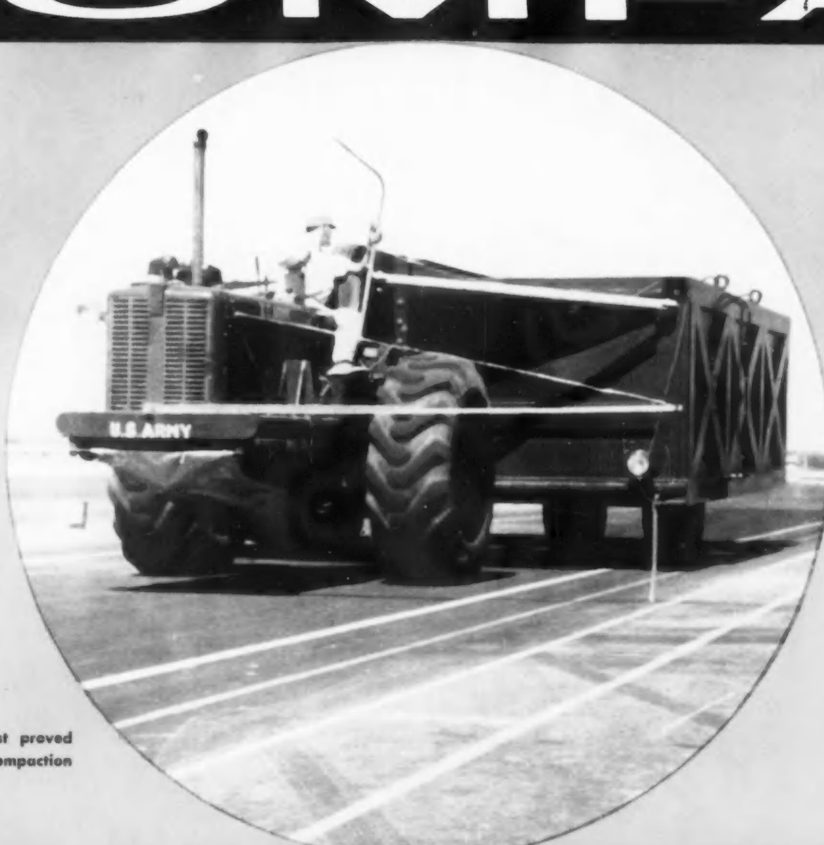
PROPER

COMPA

High

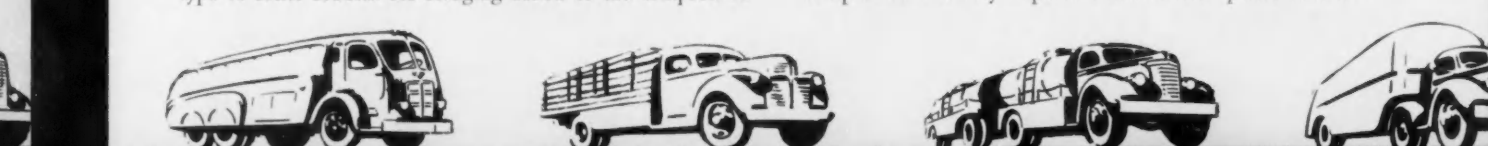
OF ASPHALT PAVEMENTS

by Fred Kimble
Materials Engineer,
Ohio Highway Department



Columbus AFB Test proved need for better compaction

Fred W. Kimble, PE, asphalt pavement engineer for the Ohio State Highway Department, is an outstanding authority on compaction. He has been responsible for numerous innovations in asphalt pavement construction, including the development of a mobile laboratory which, in a matter of minutes, can determine the degree of compaction and the percent voids in asphalt concrete. His work in this field led to the development of the earliest pneumatic-tire self-propelled roller. Mr. Kimble is an active member of the Association of Asphalt Paving Technologists, the American Society for Testing Materials and the Highway Research Board.



CTION

h pressure tires, heavy loads, call for high-density pavements

PROPER compaction of asphalt concrete is influenced by such factors as atmospheric temperature, pavement or base temperature, mix temperature, sunshine, cloudiness, humidity, workability of mix and others, that change from day to day, and their bearing on the result is learned to a great extent by experience.

Nevertheless, there are certain basic principles which must be observed. And there are new factors being introduced into the compaction picture which deserve our attention. In this discussion we will review these fundamentals and examine these new elements.

Initial rolling should follow the spreading operation immediately or soon thereafter. On hot summer days there may be some advantage in delaying the initial rolling for a short time, to allow the spread mixture to cool, or for some other special reason. However, it is better to adjust the temperature of the delivered mix and eliminate this period of cooling. This has the advantage of reducing the danger of loss of penetration of the bituminous binder which can occur at high temperatures when the binder is spread in thin films, as in the mix.

It is good practice to use a three-wheeled finishing roller for initial rolling. There are several reasons for this. This type of roller reduces the bridging action of the compression rolls and exerts greater compressive forces. Also, it is better for making longitudinal joints and causes less displacement of the spread mix because of the greater diameter of the compression rolls.

STRAIGHT EDGE TEST

Immediately following the initial rolling, the surface of the course should be checked with a straight edge for compliance with smoothness requirements. Any excessive variations from surface smoothness can usually be corrected by rolling at this time. Other surface imperfections, such as open areas, also should be corrected while the mix is still hot and areas can readily be replaced.

Subsequent and final rolling should be so timed that the required number of rollers are operating continuously. If this rolling is properly timed, it is virtually impossible to over-roll. In fact, a density equalling the ultimate or traffic density in the pavement is seldom achieved with conventional steel-wheel rollers.

Wherever circumstances permit, diagonal, crescent and circle rolling helps in achieving desired density in the pavement courses. Such changes of direction by the rollers will change the lines of force in the compactive effort and provide greater opportunity for orientation of particles in the course being compacted. Final rolling should smooth out all roller marks and leave the surface in a condition of uniform texture. This operation should be completed before the temperature of the mix has fallen below the point where rolling is effective.

ROLLER SPEED IMPORTANT

The speed of rollers through the various stages of rolling is a very important factor in the final result. For the initial compaction it is very important that rollers operate at a slow rate of speed. Some specifications set this maximum speed at 1.5 miles per hour. After initial rolling is performed, the speed of rollers should be materially increased up to as high as five miles per hour. Since the density of the pavement course is related to the total number of times the compactive effort is applied, roller speeds in excess of five miles per hour during final rolling may be beneficial.

During the past decade, engineers have been searching for a more effective means of compacting asphalt pavements than that afforded by standard steel-wheel rollers. This is particularly true in those areas where there are heavy concentrations of truck traffic. In Ohio, we have been unable to compact asphalt concrete courses with standard steel-wheel rollers so that further densification does not occur under traffic. In some cases, such lack of density develops into objectionable rutting. To achieve greater density Ohio has experimented with vibrating compactors and light self-propelled rubber-tired rollers. Although these pieces of equipment achieve slightly higher densities, traffic continues to compact the completed pavements. It appears that heavy trucks develop greater and/or different compactive stresses than standard rollers, causing particle orientation in the pavement conducive to volume reduction.

Segmented tamping roller

Combination roller

MAXIMUM DENSITY PROBLEM

The problem of traffic densification of asphalt pavement courses has been a special study in Ohio for many years. Mixes, under controlled conditions, have been placed on high density traffic highways using all types of bases including old pavements, and using different kinds of aggregates. Rolling with standard rollers was in excess of specification minimum requirements. Yet, in every instance, it was determined that there was an increase in density, due to traffic. In some cases, this increase in density takes place for as long as five years. It has been our experience that mixes, made with crushed gravel and natural sand, reach this final density in a shorter period of time than the mixes made from slag and slag sand or limestone with limestone sand.

The possibilities of rubber-tired rolling of asphalt concrete were discovered several years ago when certain areas, such as gutters (inaccessible to standard flat faced steel rollers) were compacted with the dual wheels of loaded trucks. The results were so good with the truck rolling, that it was made standard practice on specific projects such as those where corrugated metal decking covered with asphalt concrete was used for bridge floors. In these cases, rubber-tired rolling with a loaded truck compacted the asphalt concrete so well in the deep transverse corrugations that subsequent traffic did not cause the corrugations in the metal decking to be reflected to the surface. From this experience it was believed that a heavy self-propelled rubber-tired roller would perhaps furnish the needed compaction. The design and construction of such a roller was proposed to roller manufacturers.

OHIO ADOPTS NEW SPEC

When the Ohio Standard Specifications were revised in 1956, a specification for a heavy self-propelled rubber-tired roller was included. Maximum legal wheel loads in Ohio are 5,000 pounds (20,000 pound axle with dual tires). Large transport trucks operating just within this limit have tire pressures not exceeding 90 psi. With these two important factors known, the specification was written for the roller so that its weight could be varied from a 4,000 pound wheel load to an 8,000 pound wheel load. The tire pressure could be varied between 70 and 120 psi.

Tires were not to be larger than the largest transport truck tires and either smooth or treaded tires were acceptable. The spacings of the tires on front and rear of the roller were to be such that the maximum clear space not covered by the tires was not to exceed ½ inch. The minimum number of tires was seven and they were to be so mounted that on one end of the roller they oscillated in pairs and on the opposite end they could be mounted on the same axle.

During the 1957 construction season, a roller meeting the requirements of the new specification became available. The roller was used extensively during that season to compact all the courses of a new asphalt pavement. It was found by precise levels that this new roller would reduce the volume of granular bases beyond that obtained with standard rollers and vibrators. Asphalt concrete compacted with standard rollers in conjunction with this new

Trench roller

Two-axle tandem roller

Three-wheel steel roller

Roller with vibrator attachment

self-propelled pneumatic roller had densities requiring 5 to 8 years of heavy traffic to develop.

Unconfined compression tests of cores removed from the completed asphalt concrete pavement showed the stability of the rubber-tired compacted sections to be significantly above the stability of the sections compacted with the standard rollers alone. Density tests showed the rubber-tired compacted section to have very uniform density while adjacent cores compacted with standard rollers varied widely. These tests were conducted with the treaded tires of the roller inflated to 120 psi with 8,000 pound wheel loads.

LENGTHENS CONSTRUCTION SEASON

Another interesting and attractive possibility this roller provides is the lengthening of the construction season. To illustrate this possibility two projects are cited which were constructed on one of our heavily traveled highways during the months of October and November 1958. These projects were adjacent and the only significant difference between the operation of either project was the use on one of the self-propelled pneumatic roller meeting the specification mentioned above. In the spring of 1959 the rubber-tired compacted project was in perfect condition as to the surface and joints while the project compacted only with standard rollers showed extensive surface distress in the form of eroding and raveling of joints and the less dense areas of the surfacing.

It is believed this roller provides the compaction that is presently needed for use in conjunction with standard rollers to compact the courses of heavy-duty asphalt pavements to a state of density and stability sufficient to withstand presently imposed traffic stresses without permanent objectionable deformation. This roller is now being required, in conjunction with standard rollers, on all heavy duty asphalt pavement construction on our Interstate and Primary highway system.

Following is the Ohio Department of Highway's specification for pneumatic-tired rollers:

CE-1.04 Pneumatic-Tired Rollers. Pneumatic-tired rollers shall be equipped with tires of equal size and diameter which shall be uniformly inflated so that the air pressure of the several tires shall not vary more than 5 pounds per square inch.

Type 3-P Pneumatic-Tired Rollers. Pneumatic-tired rollers of this type shall be self-propelled and meet the following requirements:

Minimum weight, without ballast	21,000 pounds
Minimum weight, with ballast	56,000 pounds
Maximum size tires	13 x 25-18 ply
Minimum size tires	10 x 20-14 ply
Tire inflation pressures	75 to 120 psi
Minimum wheel load	4,000 pounds
Minimum wheel load, with full ballast	8,000 pounds
Maximum clear space not covered between tires of front and rear rolls	½ inch
Tires may be treaded or smooth, minimum number of tires	7
Wheels on either the steering or rear rolls shall oscillate in pairs	

Vibrating compactor

Three-axle tandem roller

DIAMOND OUT OF THE *Rough*

Top: Typical Delaware dirt road before stabilization and stone cover. Below: First phase is stabilizing with asphalt and compacting

After being well mixed with the emulsion the soil is thoroughly rolled

DELAWARE STABILIZATI

DELAWARE is called the "Diamond State," not because it abounds in little precious stones, but because—as one caustic geologist put it—it has precious little stone.

The state, second only to Rhode Island in microcosmic grandeur, is virtually destitute of road stone. Sand, silt and clay it has in abundance. But road-building aggregate must be imported.

Consequently, when the state legislature in 1956 voted $10 million to launch an all-inclusive road surfacing program, the Delaware Highway Department tackled an heroic stabilization project involving some 1600 miles of dirt roads. Since the county road system is incorporated in the state system, this means that Delaware proposes to leave not a grain unturned on its entire dirt road network between now and 1965.

ACCENT ON ASPHALT

Basically, this is an asphalt stabilization program. Better than 90 percent of the work will fall in this category, with some soil-cement treatment and a few experimental sections of sodium chloride and calcium chloride treatment. In

A traveling mixer blends the native material with an asphalt emulsion

Materials compact to a thickness of four inches

Stabilized road is finished off with double chip armor coat

TI ON PROGRAM TO PAVE ALL STATE'S DIRT ROADS

every case, the stabilized surface is topped off with a double seal coat of asphalt.

With 570 miles of rambling dirt roads surfaced since the program was launched in 1956, the crews are maintaining a schedule which calls for the improvement of about 160 miles per year. Some 324 miles have been blocked out for stabilization and upgrading during the 1960 and 1961 construction seasons and some contracts already have been let. Meanwhile, during the winter months, laboratory technicians are diligently evaluating soil samples from those road sections scheduled for improvement in 1960.

TWO METHODS USED

Delaware is employing two methods of mixing asphalt with the road soil. The most common method is to blade the native material into windrows, after which a traveling mixer picks it up and mixes it with asphalt emulsion at a rate of approximately two gallons per square yard. This achieves a four-inch thickness after compaction.

An alternate method is to scarify the existing roadbed, then spread the asphalt emulsion by distributor at a rate of between 0.5 and 0.6 gallon per square yard. The traveling mixer then blends the soil and asphalt, sometimes repeating the process three or four times before compaction.

The state's sprawling network of dirt roads range in width from fourteen to 22 feet. The present program contemplates bringing them all up to a minimum width of twenty feet. Cost per mile is running between $16,000 and $17,000 for the asphalt stabilized sections.

FEW FAILURES

There have been a few isolated areas of distress which have developed, but the Delaware engineers are neither surprised nor disturbed. In all instances, the reasons for the distress have been determined and speedy repair has prevented extensive failure.

Meantime, also, laboratory soils studies have been geared to the fast-moving program and these careful evaluations coupled with advancing know-how by the field crews are expected to improve future work.

ASPHALTOPICS

Someone-Up-There-Likes-Us Department: Persistent rumors have been winging around the Strategic Air Command circuit that an asphalt-paved runway at Columbus Air Force Base has become rough with usage. This is strictly a phony, but someone keeps pumping air into it and recently an inspecting colonel dropped in at Columbus to check out the rumor personally. The runway was plainly as smooth as a table-top, so the visiting colonel buttonholed a B-52 pilot who had just swooped in from the wild blue yonder. The puzzled pilot denied any roughness and, in fact, asserted that the Columbus runway is the smoothest he ever landed on. Then he volunteered a kicker. The roughest runway in his experience, he said, is the one at Carswell Air Force Base (not asphalt-paved).

* * *

Let Us Spray: The Wisconsin Highway Department has been passing the pigment at a record rate during the past year. The Badger State adopted the edge-striping principal with enthusiasm, painting two thousand miles of four-inch white stripes for greater safety and improved traffic guidance . . .

* * *

From Bad to Verse: We are happy to report that the age of poet laureate isn't dead. Not, at least, in the homeland of Tennyson. Saluting the construction of the London-Birmingham motorway, the BBC in November raised the following paean of praise to the "black gang":

ASPHALTER'S SONG

You can talk about your concrete and the boys who work the train,
And the fellas on the hoppers in the sun and wind and rain,
But the boys who lay the black-top, sure you ought to see them belt
When they're working on the highway laying hot asphalt.

Chorus:
We've laid it in the hollows and we've laid it on the flat,
If it doesn't last forever, then I swear I'll eat my hat.
I've traveled up and down the world and, sure, I never felt
Any surface that was equal to the hot asphalt.

There were boys from Connemara, County Mayo and Kildare
And the Sligo pincher-kiddies, sure all Ireland was there;
We was working all around the clock, you should have seen us belt,
We was racing up the highway laying hot asphalt.

We spread it in the summer, and we rolled it nice and hot,
Two million yards and more of it, we had to roll the lot,
And the sun was blazing down until I thought me back would melt,
Working on the motorway laying hot asphalt.

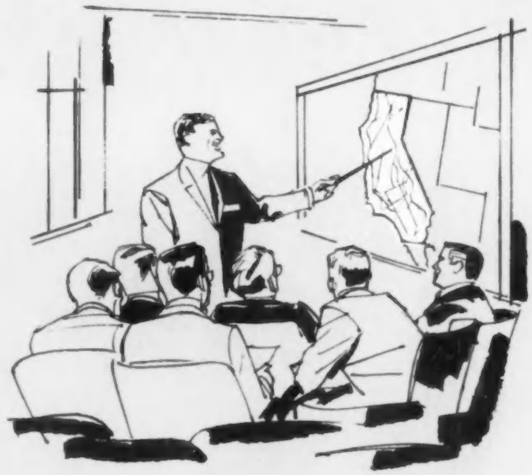
When you're speeding in your motor and tearing through the shires,
And the only thing you're hearing is the humming of the tyres,
You'll be riding soft and easy with the road as smooth as felt,
Then it's: Don't forget the boys who laid the hot asphalt!

Chorus:
We've laid it in the hollows and we've laid it on the flat,
If it doesn't last forever, then I swear I'll eat my hat.
I've traveled up and down the world and, sure, I never felt
Any surface that was equal to the hot asphalt.

We can't find any felt with the sentiment of this pastoral, but we'll have to call a helt to that kind of rhyming.

We Shall Never Be

California Solon Sees



"ONE important thing we have learned about this dynamic state of ours. We shall never be through with the job of planning and building transportation facilities . . ."

In the same breath, "Mister Highways" of the California Senate—the Honorable Randolph Collier—warned the directors of The Asphalt Institute that the great 13-year Federal-aid road program is only the beginning.

"Each step leads to another," said Senator Collier, "and we must periodically review what we have already done to be sure it accords with changing conditions."

WARNS AGAINST COMPLACENCY

Speaking before a meeting of the Institute directors at San Diego, the California legislator and co-author of the Collier-Burns Highway Act of 1947 warned:

"Too many people have become complacent simply because a so-called 13-year 'grand plan' was enacted into law by the Congress in 1956. They have not yet learned what we in California found out the hard way—that a successful highway program requires constant attention. Unfortunately in this situation, the National government has the initiative, and, unhappily, if there is any let-down in the federal program it will be a few of the more progressive states, including California, that will suffer the consequences. Some of the less progressive states, never having been fully attuned to the federal program and its objectives, will simply welcome any delays as a breathing spell."

Senator Collier reported that his state is developing a road system which is expected to handle three times the present volume of traffic in 1980. Other states, he pointed out, should anticipate a proportionate growth.

"In my own view," he declared, "it is childish to assume that we can perpetuate existing routes for major lines of

Through With the Job

Danger of Complacency

Randolph Collier has been a member of the California State Senate since 1938, representing the counties of Siskiyou and Del Norte. He was co-author of the "Collier-Burns Highway Act of 1947" and has been prominently identified with highway legislation through six Senate terms. He is chairman of the Senate Fact-Finding Committee on Transportation and Public Utilities and chairman of the subcommittee on Legislative Problems on Highway Operations. Senator Collier also serves as a member of the Western Interstate Committee on Highway Policy Problems and on the California Commission on Interstate Cooperation.

travel. The kind of growth we anticipate for California—and, in fact for the nation—cannot possibly be accommodated without an extensive system of freeways and expressways that will incorporate access control and many so-called traffic diversions. In fact, without such engineering advances our communities will be literally strangled by traffic, whereas they will be made cleaner, safer, and generally more wholesome when traffic without direct interest is removed."

Senator Collier also called for a Declaration of Independence for highway engineers.

"In particular," he said, "I would stress that highway engineering must be done by engineers, not by politicians or pressure groups. I am confident that the success of our highway programs in California must be attributed in a large measure to the degree of freedom in regard to engineering decisions granted to our engineers by the State Legislature and the Highway Commission. And I might add that this is true not only for determination of precise route locations but, more especially, in the design of projects and the selection of materials."

MISSING LINKS NEXT

The speaker concluded with a sober reminder that the next phase of our national highway program will have to be devoted to integrating the important county roads and city streets into the road network. These, he pointed out, are the principal connectors and feeders and they must be fitted into the larger picture.

"Anything less than such a program," he said, "will result in wide dispersal of additional funds in maintenance and patch-work operations that will do little to improve our total transportation plant."

For the asphalt revetment work along the Mississippi River a mix plant is mounted on a barge and floated to the job

The hot asphaltic mixture was loaded into large spreader boxes which were drawn up to the top of the slope by a winch, then returned by a tractor attachment

This is a view of an asphalt revetment that was installed more than ten years ago

Asphalt River-Bank Paving

TAMING THE MIG

The spreader boxes were loaded by clamshell bucket at the foot of the slope and the mix was spread as the box was drawn up the slope.

THE 1959 construction season saw another campaign in the unending battle between the "Father of Waters" and the U. S. Army, Corps of Engineers.

A total of eighty thousand tons of asphalt upper bank paving was placed by contract along the Mississippi River in the Vicksburg Engineer District during the first forty-four days of the current work season. This was placed at an average of more than 1800 tons per day and continued until a rising river forced a change to a less efficient operation of paving by strips. Briefly this operation consisted of spreading a continuous course of a hot mixture of asphalt and bar-run sand to an average thickness of five inches, uncompacted, at specified river bank locations, already prepared by grading to slopes not greater than one vertical to three horizontal. This work was part of the continuing revetment program designed to stabilize the banks of the river.

UNCOMPACTED SHEET USED

The engineers have adopted the technique of the uncompacted course of asphalt and bar-run sand for two main reasons: First, the bar-run sand, being virtually devoid of material passing the 100 mesh sieve, makes for a pervious pavement which permits water to seep through and avoids damaging hydrostatic back-pressure; and second, the pavement is uncompacted to allow for some adjustment and in the event of displacement or loss of material in the bank underneath.

Specifications required that the sand be excavated, not pumped, and sieve analysis at the several locations showed that the gradation stayed within narrow limits, with all material passing the sixteen mesh sieve and an average of only about three percent passing the hundred mesh sieve. The asphalt cement specified was an 85-100 penetration grade, and constituted, normally, six percent by weight of the mix.

PLANT MOUNTED ON BARGE

Except for the dozers, spreader boxes, and miscellaneous equipment used for the actual paving operation, all of the contractor's plant was mounted on barges. The main components of the mixing plant were two seven by thirty-five foot dryers (to thoroughly dry the very wet sand) and a continuous type mixer, rated at two hundred and fifty tons per hour. This mixer discharged into a steel bin from which it was picked up by clamshell bucket and placed in one of two ten to 12-yard spreader boxes. While one box was being pulled up the bank by tractor winch, spreading the mix; the second box was being moved back down to the foot of the bank by an ingenious lift on the front of a second tractor and being filled there.

According to conservative engineering estimates, the uncompacted asphalt revetments should have a minimum useful service life of twenty years. The continuing excellent performance of many similar installations that have been in place for ten years or longer support this judgment.

HTY MISSISSIPPI

A-S-P-H-A-L-T Spells Economy

by Eugene M. Stone

EUGENE M. STONE
Chairman, Board of Directors

Chairman of the Board of Directors of The Asphalt Institute for 1960 is Eugene M. Stone, president and director of Empire Petroleum Company, Denver, Colorado. A native of Nanafalia, Alabama, Mr. Stone studied at the University of Alabama before heeding Horace Greeley's advice to go West where he founded Empire Petroleum Company in 1939 and built it into one of the most enterprising independent oil companies in the Rocky Mountain area.

The construction year is rich with possibilities for the asphalt industry.

It is axiomatic that, when construction funds are tight, the basic economy of asphalt paving has an extraordinary appeal. Already, in 1959, we have seen the great Federal-aid road program falter for lack of working funds. Only the speedy enactment of a supplemental gasoline tax increase breathed fresh life into the program.

This was stop-gap legislation. It was left to the second session of the 86th Congress, convening this month, or the 87th Congress to take a long and critical look at the highway program and determine a future course of action.

Meanwhile, however, the 1959 financial crisis has had a salutary effect, as far as our industry is concerned. It served to remind the administrators of this vast public works program that construction funds are not unlimited. It served, also, to bring into sharper focus some glaring discrepancies in design standards and construction practices among the several states. We can reasonably expect that 1960 will bring a new respect for the road-building dollar. It must follow from this that the advantages of asphalt construction will receive an increasingly thoughtful appraisal.

In 1959 we saw the first experimental installations made with the new equipment designed to facilitate the asphalt treatment of railroad roadbeds. We have reason to hope that several other important railroads will avail themselves of the opportunity in 1960 to use this equipment. The market potential here is substantial, and the savings in maintenance-of-way costs to the railroads also are potentially tremendous. There is an important new market for asphalt here and 1960 may see it starting to open up.

All the readily visible signs point to a buoyant year for asphalt products.

EXECUTIVE COMMITTEE

Bottom row—E. E. Scholer, Shell Oil Co., St. Louis; M. O. Hardy, D-X Sunray Oil Co., Tulsa; Chairman Eugene M. Stone, Empire Petroleum Co., Denver; L. W. Walker, Leonard Refineries, Inc., Alma, Mich.; William N. Ruppel, Atlantic Refining Co., Philadelphia; C. W. Turner, American Bitumuls & Asphalt Co., San Francisco. Top row—Treasurer J. J. Tumpeer, Witco Chemical Co., New York; Francis H. Brown, Mobil Oil Co., Kansas City, Mo.; retiring Chairman Don L. Nielsen, Union Oil Company of California, Los Angeles; J. W. McCracken, Byerlyte Corp., Cleveland; A. R. Curtis, Esso Standard Oil Co., New York. Not present when the picture was made were Charles P. Taylor, Wilshire Oil Company of California, and A. T. Van Pelt, Berry Asphalt Co., Magnolia, Ark.

THE ASPHALT INSTITUTE

EXECUTIVE OFFICES AND LABORATORIES

Asphalt Institute Building
Campus—University of Maryland
College Park, Maryland

MEMBERS OF THE ASPHALT INSTITUTE

(As of January 1, 1960)

The Asphalt Institute is an international, nonprofit association sponsored by members of the petroleum asphalt industry to serve both users and producers of asphaltic materials through programs of engineering service, research and education. Membership is limited to refiners of asphalt from crude petroleum. Institute members provide quality products and advocate quality construction and timely maintenance.

ALLIED MATERIALS CORPORATION
Oklahoma City, Oklahoma
AMERICAN BITUMULS & ASPHALT COMPANY
San Francisco, California
Baltimore, Maryland
AMERICAN PETROFINA COMPANY OF TEXAS
Dallas, Texas
ANDERSON-PRICHARD OIL CORPORATION
Oklahoma City, Oklahoma
ASHLAND OIL & REFINING COMPANY
Ashland, Kentucky
THE ATLANTIC REFINING COMPANY
Philadelphia, Pennsylvania
BERRY ASPHALT COMPANY
Magnolia, Arkansas
BERRY REFINING COMPANY
Chicago, Illinois
BRITISH AMERICAN OIL CO. LTD.
Toronto, Ontario, Canada
BRITISH PETROLEUM COMPANY LTD.
London, England
BYERLYTE CORPORATION
Cleveland, Ohio
CANADIAN HUSKY OIL LIMITED
Calgary, Alberta, Canada
THE CARTER OIL COMPANY
Billings, Montana
CITIES SERVICE OIL COMPANY (PA.)
New York, N.Y.
COMPANIA ESPANOLA DE PETROLEOS, S.A.
Madrid, Spain
COSDEN PETROLEUM CORPORATION
Big Spring, Texas
DERBY REFINING COMPANY
Division of Colorado Oil and Gas Corporation
Wichita, Kansas
DOUGLAS OIL CO. OF CALIFORNIA
Los Angeles, California
D-X SUNRAY OIL COMPANY
Tulsa, Oklahoma
EDGINGTON OIL REFINERIES, INC.
Long Beach, California
EMPIRE PETROLEUM COMPANY
Denver, Colorado
Sheboygan, Wisconsin
EMPIRE STATE OIL COMPANY
Thermopolis, Wyoming
ESSO STANDARD OIL COMPANY
New York, N.Y.
FARMERS UNION CENTRAL EXCHANGE, INC.
Billings, Montana
GENERAL ASPHALTS, INC.
A subsidiary of Kerr-McGee Oil Industries, Inc.
Oklahoma City, Oklahoma
GOLDEN BEAR OIL COMPANY
Los Angeles, California
GREAT NORTHERN OIL COMPANY
St. Paul, Minnesota
HUNT OIL COMPANY
Dallas, Texas
HUSKY OIL COMPANY
Cody, Wyoming
IMPERIAL OIL LIMITED
Toronto, Ontario, Canada
LEONARD REFINERIES, INC.
Alma, Michigan
LION OIL COMPANY
A Division of Monsanto Chemical Company
El Dorado, Arkansas
MACMILLAN PETROLEUM CORPORATION
El Dorado, Arkansas
Los Angeles, California
MARUZEN OIL COMPANY LIMITED
Osaka, Japan
MOBIL OIL COMPANY
A Division of Socony Mobil Oil Co., Inc.
New York, N.Y.
MONARCH REFINERIES, INC.
Oklahoma City, Oklahoma
NORTHWESTERN REFINING COMPANY
St. Paul Park, Minnesota
AB NYNAS-PETROLEUM
Nynashamn, Sweden
PALOMAR OIL & REFINING CORPORATION
Bakersfield, California
PAZ OIL AND TRADING COMPANY LTD.
Haifa, Israel
PHILLIPS PETROLEUM COMPANY
Bartlesville, Oklahoma
RAFFINERIE BELGE DE PETROLES, S.A.
Antwerp, Belgium
RICHFIELD OIL CORPORATION
Los Angeles, California
JEFF P. ROYDER
Houston, Texas
SHELL INTERNATIONAL PETROLEUM COMPANY, LTD.
London, England
SHELL OIL COMPANY
New York, N.Y.
San Franciso, California
SHELL OIL COMPANY OF CANADA, LTD.
Toronto, Ontario, Canada
SINCLAIR REFINING COMPANY
New York, N.Y.
SOCAL OIL & REFINING COMPANY
Huntington Beach, California
SOUTH AFRICAN TORBANITE MINING AND REFINING CO. LTD.
Boksburg North, Transvaal
THE SOUTHLAND COMPANY
Yazoo City, Mississippi
STANDARD OIL COMPANY OF BRITISH COLUMBIA, LTD.
Vancouver, B.C., Canada
THE STANDARD OIL COMPANY
(An Ohio Corporation)
Cleveland, Ohio
SUN OIL COMPANY
Philadelphia, Pennsylvania
UNION OIL COMPANY OF CALIFORNIA
Los Angeles, California
U. S. OIL AND REFINING COMPANY
Los Angeles, California
WILSHIRE OIL COMPANY OF CALIFORNIA
Los Angeles, California
WITCO CHEMICAL COMPANY, INC.
Pioneer Products Division
New York, N.Y.

INSTITUTE ENGINEERING OFFICES

(As of January 1, 1960)

DIVISION I—ATLANTIC-GULF

NEW YORK 20, N.Y.—1270 Avenue of the Americas
New York City, Long Island and New Jersey

BOSTON 16, MASSACHUSETTS—419 Boylston Street
Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont

ALBANY 7, NEW YORK—11 North Pearl Street
New York State (except New York City and Long Island)

HARRISBURG, PENNSYLVANIA—800 North Second Street
Delaware, Pennsylvania

RICHMOND 19, VIRGINIA—Travelers Building
District of Columbia, Maryland, North Carolina, Virginia

ATLANTA 9, GEORGIA—881 Peachtree Street, N.E.
Florida, Georgia, South Carolina

MONTGOMERY 4, ALABAMA—79 Commerce Street
Alabama, Tennessee

NEW ORLEANS 18, LOUISIANA—Maison Blanche Building
Louisiana, Mississippi

DIVISION II—OHIO VALLEY-GREAT LAKES

COLUMBUS 15, OHIO—Neil House
Indiana, Kentucky, Michigan, Ohio, West Virginia

LANSING 16, MICHIGAN—109 West Michigan Avenue
Michigan, Northern Indiana

LOUISVILLE 7, KENTUCKY—4050 Westport Road
Kentucky, Southern Indiana

DIVISION III—MIDWEST

ST. PAUL 4, MINNESOTA—1951 University Ave.
Colorado, Illinois, Iowa, Idaho, Kansas, Minnesota, Montana, Missouri, Nebraska, North Dakota, South Dakota, Utah, Wisconsin, Wyoming

PIERRE, SOUTH DAKOTA—104 South Euclid
North Dakota and South Dakota

CHICAGO 39, ILLINOIS—6261 West Grand Avenue
Wisconsin and Metropolitan Chicago

SPRINGFIELD, ILLINOIS—2606½ South Sixth Street
Illinois, (except Chicago), St. Louis County, Missouri

KANSAS CITY 3, KANSAS—2500 Johnson Drive
Kansas, Missouri (except St. Louis Co.), Nebraska

DENVER 2, COLORADO—1031 15th Street
Colorado, Utah, Wyoming

HELENA, MONTANA—Power Block
Idaho and Montana

DIVISION IV—SOUTHWEST

DALLAS 6, TEXAS—Meadows Building
Arkansas, New Mexico, Oklahoma, Texas

AUSTIN 1, TEXAS—Perry-Brooks Building
Texas

OKLAHOMA CITY 2, OKLAHOMA—Republic Building
Arkansas, Oklahoma

SANTA FE, NEW MEXICO—10 Radio Plaza
New Mexico, Western Texas

DIVISION V—PACIFIC COAST

BERKELEY 10, CALIFORNIA—810 University Ave.
Alaska, Arizona, California, Hawaii, Nevada, Oregon, Washington

LOS ANGELES 17, CALIFORNIA—1709 West 8th St.
Arizona, Southern California

OLYMPIA, WASHINGTON—National Bank of Commerce Building
Alaska, Washington

SACRAMENTO 14, CALIFORNIA—Forum Building
Central California, Northern California, Nevada

PORTLAND 1, OREGON—2035 S.W. 58th Avenue
Oregon

Printed in the U.S.A.